

BEST PRACTICE PROGRAMME

Good Practice Guide

28

**Energy Audit and Survey Guide:
For Building Managers and Engineers**

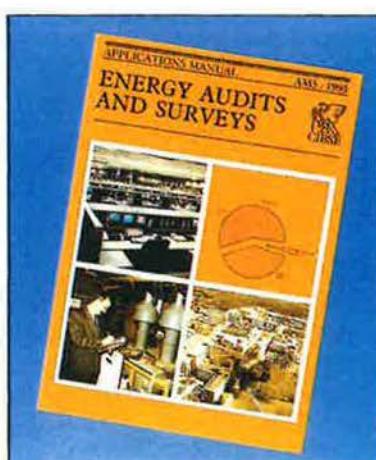
Background

Energy audits and surveys offer substantial opportunities for increasing energy efficiency in buildings, but some prospective users find they need better guidance to carry out their own audits and surveys or to select a service appropriate to their needs from the wide range of professional services available.

Working together, BRECSU and CIBSE have developed the new CIBSE Applications Manual: "Energy Audits and Surveys" which provides authoritative guidance for organisations considering an audit and survey of their buildings. The Manual explains how to conduct or specify audits and surveys and implement the findings to save energy and money.

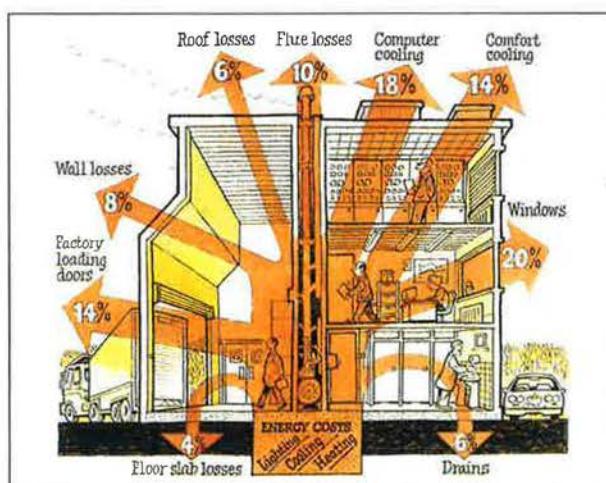
Readers are helped to identify their own particular needs and select the approach to be adopted. They are encouraged to make full use of their own skills and commission outside assistance as required to implement the survey and its recommendations. Routine annual audits are recommended as good business practice. Site surveys performed typically every three to five years should ensure that new opportunities are not missed. Energy audits and surveys will then provide the basis for a system of energy cost control.

- Reduced operating costs
- Increased profits
- Management information
- Environmental benefits
- Efficient working practices
- Improved working conditions



Copies of the Applications Manual can be purchased from:

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London SW12 9BS
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ENERGY AUDIT

AND SURVEY

GUIDE:

FOR

COMMERCIAL

AND INDUSTRIAL

BUILDINGS



Energy Efficiency Office
DEPARTMENT OF ENERGY

BUILDING MANAGERS AND ENGINEERS

Target audience

The Manual is aimed at organisations of all sizes throughout the public, commercial and industrial buildings sectors.

Guidance is directed not only at those likely to be involved in conducting audits and surveys but also those in a position to set policy and authorise the investment in time and effort.

The support of senior managers is essential if a survey is to be performed and the recommendations carried out in the most effective manner. Important points are summarised at the end of each section of the Manual for the benefit of this important group of people.

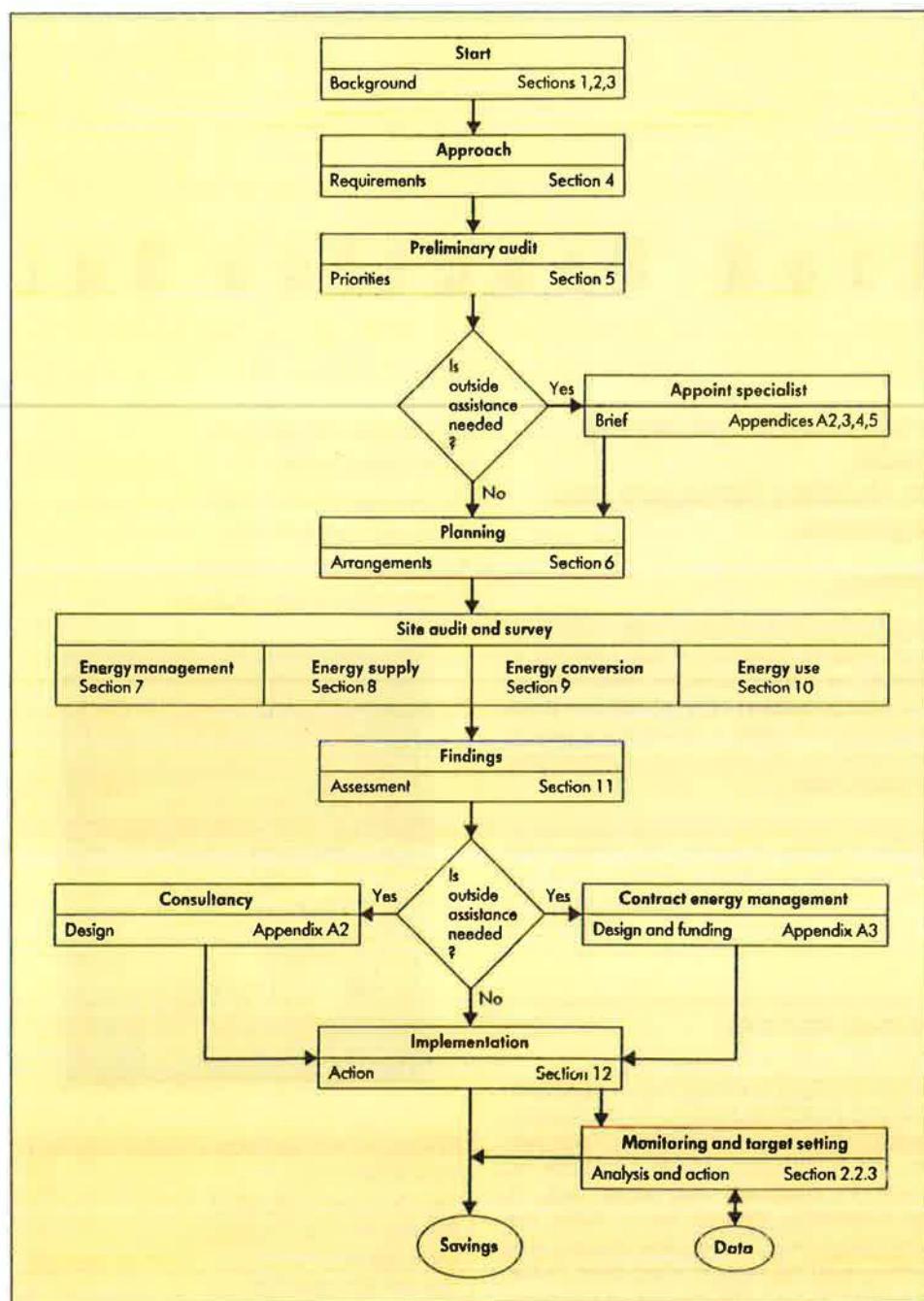
Objectives

In setting out procedures for good audit and survey practice the objectives are:

- to encourage the uptake of energy audit services and implementation of energy audit recommendations
- to encourage energy users to carry out "in-house" energy audits to the extent of their expertise
- to identify the potential of more extensive advice such as building services design or contract energy management
- to assist in the assessment of value for money from energy audits and surveys
- to assist in tendering procedure for energy audit services.

Methodology

The "Flow chart for energy audit and survey" shows how the various stages are linked. These stages correspond with the principal sections of the Applications Manual, as discussed briefly.



Flow chart for energy audit and survey

Preliminary audits

Extensive guidance is given for organisations to carry out preparatory work before a site survey is undertaken.

The main steps can be summarised as:

- collection of data
- analysis of data
- presentation of data
- establishing priorities

The techniques described for preliminary audits can be carried out with limited technical knowledge but will assist in deciding the priorities for site investigations.

Comparison with yardsticks for annual building energy consumption is recommended to provide a measure of performance. Individual buildings can be selected on this basis for further study. Reference to typical breakdowns of energy in common building types can highlight those services most likely to justify closer examination. A selective approach to site surveys is encouraged so that resources can be targeted most effectively at the highest potential savings.

Planning a site survey

Whereas the preliminary audit deals principally with the supply of energy, the site survey also examines each form of energy demand. The ways in which energy is converted, distributed and used are all potential subjects for study, as are the applied management procedures. A full investigation should deal with all of these elements to determine the best overall plan for improving energy efficiency and controlling energy costs. Studies concentrating only on selected aspects of energy management or use should still take into account the possible wider implications.

To ensure that an effective survey brief can be developed consideration must be given to:

- who will be involved
- the buildings or site boundaries
- depth of survey required
- when the survey will be performed
- what further metering or instrumentation is necessary
- restrictions on access
- requirement for reporting.

The depth of study and the detail with which it is reported will be determined by the availability of resources and the value placed on the anticipated opportunities.

Correct specification of the scope of a survey is necessary to ensure that the maximum benefits can be realised.

Model forms of brief for concise and comprehensive surveys are included to assist in the preparation of specifications. In broad terms a concise survey is defined as one that quickly identifies the main opportunities for savings. A comprehensive survey is a more detailed study to evaluate the potential savings and also identify further opportunities. The more suitable form can be selected as the basis of an agreement when specialist assistance is commissioned.

The survey needs to be timed so that it fits in with the organisation's main business. Ideally systems will be tested under operating conditions so that performance can be measured.

Site surveys

A site survey can normally be expected to examine the management, supply, conversion and end use of energy.

Each of these aspects is dealt with in sequence in the Manual. In practice, all aspects need to be considered together during a survey.

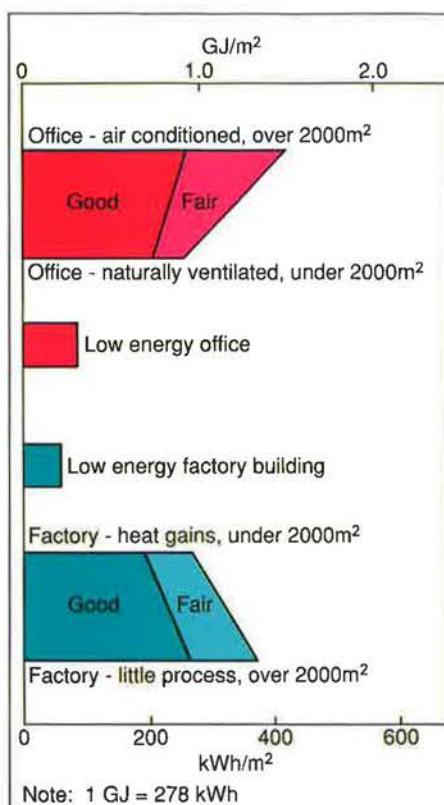
Management practices applied to the monitoring and control of energy purchase and consumption must be reviewed. The involvement of all staff at all levels in an organisation should be reviewed with reference to:

- accountability from end use to overall financial control
- procedures adopted in respect of management information.

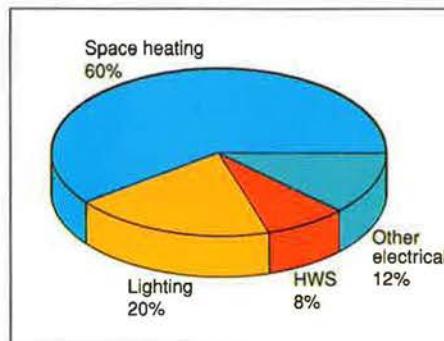
Energy supply options should be examined not only individually but also collectively to determine the best overall supply policy. Changes in the structure of the supply industries following privatisation increase the need for regular review of the purchase of energy.

The most important item to consider when reviewing energy conversion is likely to be boiler plant. Many potential improvements are suggested and advice given on how these may be investigated. Advice is also given on electricity generating and combined heat and power (CHP) plant, refrigeration plant, and distribution systems.

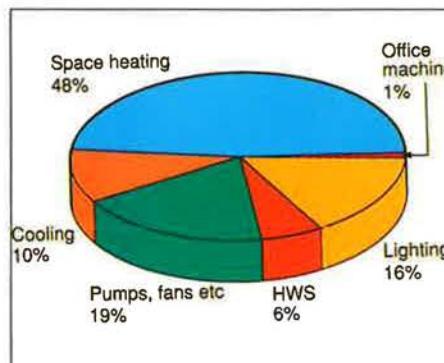
The major part of most surveys is concerned with the way that energy is used, or wasted, in meeting operational requirements. A survey does not necessarily cover all energy uses, but the principal services are usually included. An understanding of the energy flow through a site or building is a fundamental requirement. At this level it is normal to consider complete services, taking account of how they interact and identifying useful output and losses. The same approach can be applied to individual processes, remembering that overall the energy flow across system boundaries must balance.



Yardsticks for annual energy consumption of office and factory buildings compared with low energy buildings



Energy use in a typical office building (naturally ventilated)



Energy use in a typical office building (air conditioned)

Evaluating the survey findings

A survey will identify various options for investment and energy saving. The findings must be evaluated and presented to the level of management with authority to act to implement recommendations.

The savings anticipated from each of the options identified should be estimated. Savings can usually be based on:

- estimated percentage of annual consumption
- direct saving from a reduction in fuel cost, load, operating hours or energy loss.

A financial appraisal of the economic benefits of each measure is then needed to determine the optimum investment programme.

Implementation of the recommended measures

Audits and surveys produce valuable information for the management of any business. However, the maximum benefits are only realised when the available savings measures are implemented.

The Manual recommends that an action plan should be prepared which shows:

- the action required, such as design, tendering, installation, supervision and other tasks
- the personnel who will perform the tasks
- who should be informed or may be affected
- when, and with what priority, each measure will be implemented.

The Manual also emphasises the need for continued commitment to maintaining savings following the implementation of measures.

Energy performance

Even the best low-energy office has an annual energy bill of some £4/m² treated area. For most buildings, the figure is considerably higher, depending on the type and use.

- What is the cost of energy in your building(s)?
- Is this higher than necessary to meet your own particular requirements?
- Does energy account for a higher proportion of your operating costs than other organisations in your sector?
- How does the energy performance of your building(s) compare with others of similar type?
- When was an energy survey last carried out in your building(s)?
- Did you implement the recommendations?
- What cost effective measures are still available to reduce the cost of energy used in the building(s)?
- What steps should you take to ensure that you can identify and implement these measures?

To answer all of these questions you will need to carry out an audit and survey.

Simple savings measures

Ideally, your organisation will already employ an energy manager, at least part-time, who could carry out much of the first stage and most cost-effective energy auditing activity.

Many savings measures can not only be identified quickly but also offer very good payback periods, e.g.

Payback period

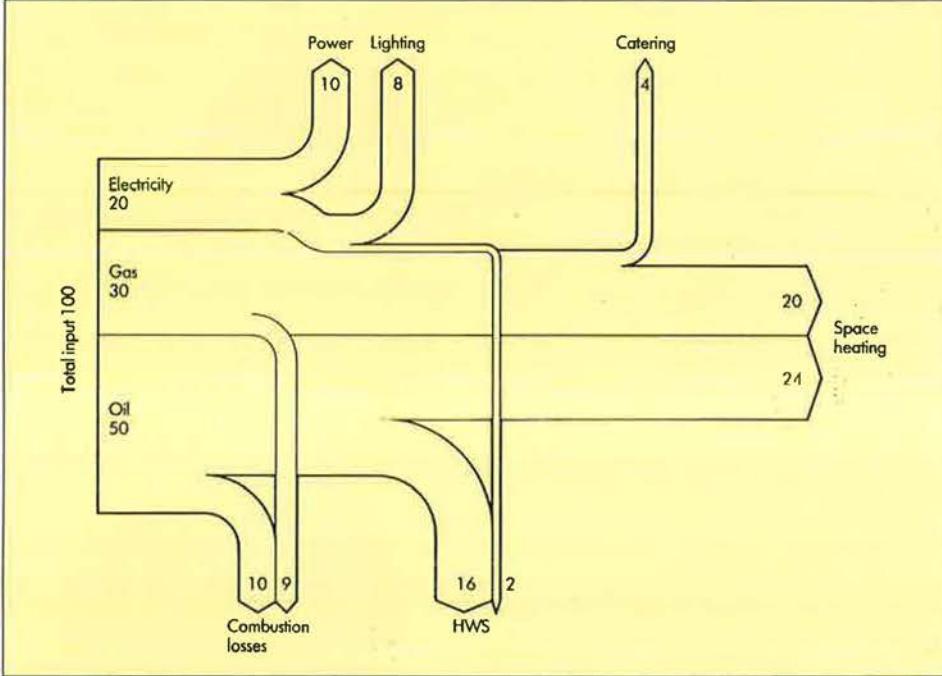
Good housekeeping;
adjustment of control
settings; tariff change

Nil

Draughtproofing;
installation of time
switches, thermostats
or other basic controls;
boiler/burner adjustments

Typically
1-3 yrs

An Energy Efficiency Office study of thousands of energy surveys showed that average potential savings of about 20% of each site's energy bill were identified. The average payback period for implementing all the recommended measures together, including no cost measures and items with a capital cost, was 1.5 years. Even when outside assistance is used, the typical survey costs of between 1% and 5% of an annual energy bill are recovered rapidly through reduced running costs.



Sankey diagram of energy flows

Environmental benefits

Measures that reduce the combustion of fossil fuels have the added benefit of reducing emissions that may have a harmful effect on the environment.

The table shows the CO₂ emissions and 1990 costs of different fuels.

Fuel	kg CO ₂ per unit	kgCO ₂ /kWh	p/kWh
electricity	0.83kg/kWh	0.83	5.2
gas	5.7kg/therm	0.20	1.3
oil (class D)	3.1kg/litre	0.30	1.0
coal	2.7kg/kg	0.33	0.8